Space Weather Forecast

Issued on Friday, 01 December 2023 at 13:24 Local

This forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: G2-G3 Moderate to Strong Geomagnetic storms expected at first, easing later day 1 (01 Dec). Chance of Moderate flares (R1-R2 Blackouts).

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Moderate with the peak event a single low-level Moderate flare at 01/0439 UTC from a region in the northwest of the visible disc. There are currently ten sunspot regions with the largest, and previously the most active a moderately sized region in the southwest quadrant which is comprised of a cluster of spots with moderate magnetic complexity. All other regions on the disc remain smaller and simpler, and generally either stable or showing signs of decay. The largest flare of the period from one of these smaller regions in the northwest quadrant appeared to undergo slight development, although it is now approaching the western horizon and becoming increasingly difficult to assess.

A number of filaments (lines of the Sun's material held together by the magnetic field) currently lie on the Earth facing side of the Sun and can erupt to produce coronal mass ejections (CMEs). Two of these appeared to liftoff during the period, both of these from the southwest disc. One around 30/1700 UTC and the other at approximately 01/0600 UTC. Neither of these appear to have resulted in any notable CMEs in available imagery. Other CME signatures in solar imagery during the past 24 hours are considered far-sided and thus not Earth-directed.

Solar Wind / Geomagnetic Activity: Solar wind speeds remained at Background levels for most of the day on 30 Nov with speeds around 350km/s, but late in the day the speed jumped to Slightly Elevated levels, reaching 450 km/s. Speeds slowly declined to around 400km/s until 01/0850 UTC, when speeds suddenly increased to 500-560km/s (Elevated) as the larger CME from 28 Nov arrived at Earth.

The Interplanetary Magnetic Field (IMF) was Weak until the first CME arrived, increasing to mainly Moderate, but briefly Strong levels. Following the arrival of the second CME the IMF increased to more persistently Strong levels. The important north-south component of the IMF varied Weakly at first, then varied Moderately following the first CME. A stronger response was evident with the arrival of the second CME, becoming Strongly negative (southward directed) before easing to Weak or Moderately negative by the end of the period.

Resultant Geomagnetic activity was Quiet (Kp 0-1) initially, increasing to Unsettled to Active (Kp3-4) between 01/0000-0900 UTC. Activity increased further to G3/Strong Storm levels 01/0900-1200 UTC.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) persisted at Background levels with no solar radiation storms occurring.

Four-Day Space Weather Forecast Summary

Solar Activity: Low to Moderate with a chance of further isolated Moderate-flares (R1-R2 Blackout), and a very slight chance of an isolated Strong-class flare (R3 Blackout). The moderately large region in the southwest disc is most likely to be the source of any significant

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flares.

Solar Winds / Geomagnetic Activity: The CME associated with the high-level Moderate flare from the moderately large sunspot region in the southwest on 28 Nov has arrived at Earth and strongly influenced solar wind parameters with speeds currently around 500-560km/s (Elevated). No further CME arrivals are expected during the period and solar wind speeds and magnetic field strength are generally expected to ease in the next few days, however Geomagnetic activity is expected to be strongly influenced by this CME in the coming 24 hour period.

Solar winds should ease to Slightly Elevated or Background levels in the next few days. The next high speed stream enhancement is expected late day 4 (04 Dec) or early 05 Dec. Elevated winds of around 500-550 km/s are likely from this feature, though the peak solar winds may just fall outside the scope of this current forecast period.

Geomagnetic activity has reached G3/Strong Storm levels. Activity should slowly wane during the first 24 hours, but with further G1-G2 Minor-Moderate Storm intervals likely at first. Activity should become Quiet to Unsettled during day 2 (02 Dec), remaining at similar levels until the arrival of the high-speed stream late day 4 (04 Nov) or perhaps early 05 Dec (just outside the current forecast period). The onset of the high-speed stream should see activity increase Active to G1/Minor Storm (Kp 4-5) levels.

Current activity brings a chance of visible aurora to parts of the UK this evening (01 Dec) and to a lesser extent early tomorrow (02 Dec). Views of the aurora as far south as Northern England and Northern Ireland are possible given good views of the northern horizon, with a greater chance of viewing the aurora further north where skies remain clear.

Energetic Particles / Solar Radiation: The count rate of energetic particles (high energy protons) is expected to stay at background. However, any significant flares from the moderately large region in the southwest will bring a chance of flux levels increasing, with a slight chance of approaching or perhaps exceeding the S1 Minor Radiation Storm level.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	Yes	100	30	1	50
Strong	G3	Yes	80	1	1	3
Severe	G4	No	5	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	40	40	40	40
Very Active	R3 to R5 X	No	5	5	5	5

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	10	10
Very Active	≥ S3 *	No	1	1	1	1

* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)

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